NOTES

1. There is no universally accepted definition of primary products, but in this paper they are taken as those products extracted from the earth or grown or raised on the land, or harvested from the water, which enter international trade in an unprocessed or semi-processed state.

2. Corden (1974, Chapter 7) has argued that there will be an optimum trade tax structure which trades off adverse efficiency effects against favourable equity effects, hence maximizes world welfare.

3. Summarised from World Bank (1982 (a)), p.126.

4. World Bank (1982 (b)), p.109.

5. Ibid, p.47.

6. Ibid, p.106.

7. For instance, Knudsen and Parnes (1975) even find a positive relation between export instability and growth instability apparently generating more investment and growth. Since export growth nowhere appears explicitly as an explanatory variable for GNP growth, savings and investment in the Knudsen and Parnes analysis, one may wonder whether it is instability or merely its correlation with export growth that produces the authors' result. Also see MacBean (1966).

8. Many neo-classical authors have objected to the postulation of deteriorating terms of trade espoused by Prebisch (1950) and Singer (1950). For an excellent exposition, see Meier (1968).

9. Spraos (1980) has stated that a deteriorating trend in the relative price of primary products cannot be decisively refuted for 70 years prior to the Second World War. Also see Evans (1979).

10. Persaud (1978) and Singer (1982).

11. World Bank (1982 (b)), p.28.

12. The earliest expressions of the objectives of an integrated programme for commodities are contained in UNCTAD (1974).

13. For a discussion on the theoretical impasse, see Evans (1979). Recently two new ICAs (jute and tropical timber) without price provisions have been negotiated.

14. An evaluation of ICAs has shown that they have failed to achieve their goals of price stabilization; price fluctuations in some commodities have been greater during agreement years. See Behrman (1978). There are several other reasons for the slow progress made on establishing new ICAs, including differences

among developing countries on price ranges, market shares, etc.

15. World Bank (1982) (b)), p.103.

16. References made to uniform ad valorem export taxes throughout this study mean uniformity of proposed export tax rates between the countries who are members of an international export tax system; it does not mean a fixed rate.

17. Corden (1974), Chapter 7.

18. It is assumed that adjustments are made instantly.

19. Commonwealth Secretariat (1982), p.20.

20. Helleiner (1981), pp. 31-55.

21. Radetzki (1978). Several other authors have suggested the existence of oligopolistic elements in some commodity markets (Maizels (1981); Labys (1980) and Hughes and Singh (1978)).

22. Radetzki (1978), p.117.

23. Labys (1980), p.180.

24. UNCTAD (1982 (a)).

25. Fitzgerald and Pollio (1981).

26. For information additional to Table 3.1, see World Bank (1982 (b)), p.5.

27. Ibid, p.5.

28. Streeten (1982).

29. UNCTAD (1981 (c)).

30. The share of multinationals in the world trade in bananas increased from 58 per cent in 1973 to 63 per cent in 1980. See FAO (1982).

31. Both India and Sri Lanka have appointed several commissions to ascertain whether tea prices have been depressed by operation of the auction system.

32. UNCTAD (1982 (b)).

33. For an evaluation of Emmanuel's proposition, see Evans (1981).

34. Evans (1979).

35. IMF (1981), p.24.

36. In England, for example, duties were applied to exports of raw wool and hides by statute as far back as 1275 and by 1660 had been extended to 212 articles. See Goode, et al.(1966).

37. For a theoretical exposition, see Brown(1975), pp.129-133.

38 The data on processing timber in Indonesia are drawn from Takeuchi (1982).

39. The data on cocoa processing in Brazil are drawn from the author's study (1983).

40. The data are from McNerney (1983).

41. The data are drawn from Davis (1980).

42. See Ellis (1981) for an evaluation of intra-firm transfers in the banana industry in Central America.

43. Lerner (1934).

44. Strongest evidence of the uranium cartel is given by Stewart (1980).

45. Congressional Budget Office (1982).

46. Bosson and Varon (1977), p.64.

47. World Bank (1982 (b)), p.93.

48. The statistics are from the Metal Bulletin (1981).

49. For a detailed discussion, see Thoburn (1981).

50. UNCTAD (1981 (b)).

51. In India, 558 man days were taken per hectare in farms growing arabica coffee in order to accomplish all production operations (up to the green coffee stage), while only 401 man days per hectare were taken for robusta farms. For details see International Coffee Organisation (1980).

52. World Bank (1971).

53. Ibid, p.42.

54. For the nature of substitution in minerals, see Labys (1980), p.39.

55. As quoted in Bosson and Varon (1977), p.59.

56. UNCTAD (1981 (a)), p.50.

57. Wanigatunga (1983).

58. World Bank (1978).

59. On the basis of statistics given in IMF (1976) and World Bank (1976).

60. The World Bank (1982, (b)) has adopted a 'restrictive' lending policy for tea since August 1973. Under this policy the Bank has not financed projects involving production of tea but has encouraged projects for diversification out of tea. There are two exceptions: (a) financing increased output in countries without 'investment alternatives' that would yield an acceptable rate of return, and (b) financing rehabilitation involving no increase in tea output. This involves a reduction in tea acreage and the implementation of diversification measures.

ANNEX I

LIST OF ANNEX TABLES

Annex Table 1: Price Indices and Growth Rates of Primary Products

Year	All Commodities a		Major Groups b			
	Nominal c	Deflated b	Food	Beverages	Agricultural raw materials	Metals
	1975=100					
1957	57	127	90	171	163	131
1958	53	118	84	171	137	123
1959	52	117	85	146	154	121
1960	52	115	83	133	158	121
1961	50	109	79	124	145	119
1962	49	106	80	120	138	115
1963	52	113	96	118	142	114
1964	55	118	90	133	139	139
1965	54	112	82	118	132	149
1966	56	114	81	121	132	157
1967	52	106	81	119	119	132
1968	52	105	79	120	116	137
1969	56	110	82	121	119	145
1970	58	107	82	129	103	145
1971	55	96	78	112	96	118
1972	62	100	83	113	116	109
1973	95	132	110	120	178	137
1974	122	128	144	117	141	140
1975	100	100	100	100	100	100
1976	113	112	81	189	132	105
1977	137	125	72	302	117	104
1978	130	103	71	190	109	95
1979	152	106	71	177	117	109
1980	166	104	86	140	110	108
1981	142	94	78	115	105	98
1982	125	84	63	121	92	91
Growth Rate d		-1.0	-0.25	1.2	-3.1	-2.1

a Overall index of 30 primary commodities exported by developing countries (excluding gold and crude petroleum).

b Deflated by the UN index of manufactures exported by developed countries.

c In terms of US dollars.

d Least squares trend growth rates (1957 to 1981)

Source: Price indices are from International Monetary Fund, "IMF Survey", 5 April 1982, p.110.

Annex Table 2: Estimates of Price Elasticities of Demand and Supply

Commodity	Scenario I			Scenario II		
	Price Elasticity of Demand		Price Elasticity of Supply	Price Elasticity of Demand		Price Elasticity of Supply
	Developing Countries	Developed Countries		Developing Countries	Developed Countries	
Coffee	-0.15	-0.07	0.33	-0.31	-0.30	1.28
Cocoa	-0.11	-0.12	0.34	-0.33	-0.27	1.00
Tea	-0.20	-0.20	0.16	-0.50	-0.40	0.72
Bananas	-0.50	-0.50	0.21	-1.00	-0.80	1.40
Rubber	-0.50	-0.40	0.21	-1.00	-0.80	0.94
Sugar	-0.04	-0.02	0.99	-0.08	-0.05	1.50
Cotton	-0.18	-0.14	0.07	-0.56	-0.44	1.02
Tropical Timber	-0.50	-0.10	0.70	-1.57	-0.50	0.94
Palm Oil	-0.47	-0.01	0.40	1.21	-0.43	0.70
Phosphate Rock	-0.70	-0.30	0.70	-3.00	-0.70	2.90
Bauxite	-0.30	-0.20	0.60	-0.40	-0.30	3.20
Copper	-0.20	-0.19	0.40	-0.40	-0.30	1.70
Iron Ore	-0.70	-0.30	0.80	-1.90	-1.20	3.20
Zinc	-0.52	-0.52	0.40	-1.10	-1.10	1.70
Nickel	0.00	-0.60	0.44	0.00	-1.20	1.22
Manganese Ore	-0.50	-0.50	0.45	-1.20	-1.20	3.50
Tin	-0.24	-0.11	0.70	-1.20	-0.49	2.09

Sources: The World Bank, "Price Prospects for Major Primary Commodities", Various Issues; Hossein Askari and J.T. Cummings, Agricultural Supply Response A Survey of Econometric Evidence, New York: Praeger Publishers, 1976; Jere R. Behrman, "International Commodity Agreements; an Evaluation of the UNCTAD Integrated Commodity Programme", Overseas Development Council, October 1977.

Annex Table 3 : Shares of Major Producers in World Exports of Selected Primary Products

Commodity/Country	Average 1970-72	Average 1977-79
1. Bananas		
Costa Rica	12.2	12.6
Ecuador	18.5	16.5
Honduras	15.8	14.1
Panama	11.6	6.6
Colombia	2.8	6.5
Guadeloupe	2.3	4.2
Guatemala	2.5	2.4
Jamaica	2.2	1.8
Martinique	3.1	6.4
China (Taiwan)	6.2	n.a.
Philippines	2.5	8.1
LDC Share	92.1	92.5
2. Cocoa		
Brazil	8.7	14.8
Cameroon	6.6	5.8
Ghana	31.7	23.3
Ivory Coast	11.6	17.9
Nigeria	23.7	15.5
LDC Share	100.0	95.1
3. Coffee		
Brazil	30.2	17.1
Colombia	14.4	15.4
Costa Rica	2.4	2.6
El Salvador	3.5	4.6
Guatemala	3.5	4.1
Mexico	2.6	4.0
Angola	4.8	1.9
Ethiopia	2.5	2.2
Ivory Coast	5.5	6.0
Indonesia	2.2	4.7
Kenya	2.1	3.2
LDC Share	96.8	92.0
4. Tea		
Kenya	5.7	9.7
Malawi	2.0	2.2
Tanzania	0.9	1.2
Bangladesh	4.9	2.1
India	28.8	26.7
Indonesia	3.8	5.5
Sri Lanka	27.4	22.0
LDC Share	83.1	78.7
5. Sugar		
Brazil	5.8	5.0
Cuba	26.5	n.a.
Dominican Rep.	5.0	2.5
Mexico	3.3	0.2
Peru	2.5	0.8
Mauritius	2.5	2.9
Philippines	7.3	3.9
Fiji	1.4	1.5
Guyana	1.5	1.1
LDC Share	71.2	37.9
6. Palm Oil		
Ivory Coast	3.2	3.3
Indonesia	18.7	15.8
Malaysia	52.5	59.8
Nigeria	2.9	0.0
Zaire	11.3	0.4
LDC Share	100.0	81.7
7. Cotton		
Brazil	5.7	0.5
Mexico	2.8	4.5
Egypt	14.0	6.3
Sudan	7.5	5.4
Iran	2.3	1.7
Pakistan	2.6	1.1
Syria	3.1	3.0
LDC Share	56.6	47.8
8. Rubber		
Liberia	3.5	2.2
Indonesia	22.0	23.2
Malaysia	50.0	51.4
Thailand	9.5	13.4
Sri Lanka	0.0	4.1
LDC Share	97.7	98.3
9. Sisal		
Brazil	24.7	42.4
Haiti	1.4	0.9
Mexico	13.4	0.5
Angola	11.4	5.8
Kenya	6.8	10.4
Malagasy Rep.	4.3	6.0
Mozambique	3.8	4.6
Tanzania	30.5	27.5
LDC Share	97.4	98.2
10. Phosphate Rock		
Algeria	1.0	1.4
Morocco	29.2	34.4
Senegal	3.3	3.6
Togo	3.9	5.7
Tunisia	5.0	3.3
Jordan	-	4.4
Syria	0.1	1.9
Oceania	7.5	6.8
LDC Share	53.6	65.9
11. Bauxite		
Dominican Rep.	5.5	3.1
Guyana	6.9	15.1
Haiti	2.4	2.4
Jamaica	32.2	21.6
Surinam	16.6	9.2
Guinea	0.4	24.8
Greece	n.a.	4.0
Sierra Leone	2.5	0.8
Indonesia	2.2	1.4
Malaysia	2.2	0.5
LDC Share	72.6	86.1
12. Copper		
Chile	16.3	19.3
Peru	4.6	6.9
Zaire	10.0	8.1
Zambia	17.0	12.8
Philippines	4.2	4.4
Papua N. Guinea	-	4.3
LDC Share	54.0	62.8
13. Iron Ore		
Brazil	8.5	19.0
Chile	2.3	1.6
Peru	2.4	1.4
Venezuela	5.3	2.6
Liberia	6.2	4.9
Mauritania	2.8	2.1
India	5.8	4.8
LDC Share	37.7	42.3
14. Manganese Ore		
Brazil	16.4	10.9
Mexico	2.0	2.2
Gabon	20.1	21.6
Ghana	3.9	3.2
Morocco	-	3.3
India	7.8	4.2
LDC Share	56.1	75.9
15. Tin		
Bolivia	13.7	15.1
Nigeria	4.9	1.2
Zaire	2.6	0.9
Indonesia	8.5	12.8
Malaysia	42.6	36.4
Thailand	10.3	14.5
LDC Share	85.4	84.2

- Negligible.

Source: The World Bank, "Commodity Trade and Price Trends", various issues.

Annex Table 4: Export Taxes in Selected Countries: Selected Early Years

Selected Countries	Export Tax Receipts as a Percentage of Total Tax Receipts				
	1939	1947	1948	1949	1950
	per cent				
Nigeria	..	13	9	11	19
Uganda	..	25	30	46	48
Ceylon	..	..	29	29	31
India	6	..	8	8	8
Indonesia	..	14	18	11	9
Malaya	..	..	34	30	41
Pakistan	..	..	19	10	20
Thailand	..	6	8	8	8
Brazil	3	2	2	1	1
Guatemala	17	11	9	8	7
Haiti	19	22	20	19	20
Mexico	16	12	11	21	18
Peru	12	29	22	23	33
El Salvador	9	14	17	19	20

.. not available.

Source: Edwin P. Reubens, "Commodity Trade, Export Taxes and Economic Development", Political Science Quarterly, Vol. LXXI, No. 1

Annex Table 5: Taxes levied on Indonesian Exports of Timber

Tax Item	Tax (US $ per m^3)
1. ADO (export Tax, 20 percent of check price)	30.00
2. MPO EXIM (withholding corporate tax, US$ price x Rp.40)	9.60
3. Uji Kayu (gruding fee, Rp. 200/m^3)	0.45
4. Simpanan Wajib (compulsory savings for reforestration)	3.20
5. 'Fiskal' Export (PPD - 17a, withholding personal income tax on wages)	0.32
6. OPP (transportation tax, US$1/$m^3$)	1.00
7. Bea Angkutan Langsun (Rp. 50/m^3)	0.08
8. B/veem (Rp. 20/m^3)	0.03
9. IHH (royalty, 6 per cent of check prices)	9.00
10. IHH Tambahan (additional royalty, Rp. 620/m^3)	1.00
11. Bank charges (0.25 per cent of negotiated amount)	0.38
Total[a/]	55.06

a/ Some small local taxes are not listed here. The total taxes/fees paid to the Indonesian Government appear to be around 42 - 43 per cent of the FOB price of log exports.

Source: Kenji Takeuchi, "Mechanical Processing of Tropical Hardwood in Developing Countries: Issues and Prospects of Plywood Industry Development in the Asia - Pacific Region", The World Bank, Division Working Paper No. 1982 - 1, January 1982.

Annex Table 6: Market Shares of Developing Countries in Developed Countries for Selected Primary Products [a]

Product	CCCN Number	Market Share of Developing Countries (Average 1970-72)	(Average 1978-80)
		per cent	
1. Cocoa	0721	98.2	97.5
2. Coffee	0711	97.9	95.3
3. Copra	2112	98.3	99.5
4. Coconut oil	4223	82.5	91.8
5. Fish(simply preserved)	031	29.3	37.1
6. Fruit(Fresh)	051	41.1	39.3
7. Groundnuts	2211	68.8	27.6
8. Groundnut oil	4214	82.6	75.1
9. Meat(fresh, frozen)	011	20.7	9.8
10.Palm Kernel	2213	100.0	98.3
11.Palm Kernel oil	4224	63.5	85.3
12.Raw beet & cane sugar	0611	64.2	59.5
13.Tobacco(Unmanufactured)	121	33.7	44.5
14.Vegetables (fresh)	054	27.9	29.3
15.Raw Cotton	2631	69.7	52.0
16 Raw Jute	264	92.0	87.2
17.Hides & Skins	211	24.3	15.6
18.Natural Rubber	2311	96.4	97.9
19.Sisal/Henequen (Fibres)	2654	97.1	97.5
20.Wood in the rough	242-2421	52.8	52.7
21.Bauxite	2833	73.3	71.8
22.Copper(Ores, concentrates)	2831	55.4	68.2
23.Iron(ores, concentrates)	281	46.6	44.7
24.Lead(Ores, concentrates)	2834	40.4	44.4
25.Manganese(ores, concentrates)	2837	56.6	46.7
26.Phosphates (rock)	2713	61.1	63.2
27.Tin(ores, concentrates)	2836	84.5	77.9
28.Zinc(ores, concentrates)	2835	34.7	31.2

a Market shares are calculated on the basis of value.

Source : United Nations Commodity Trade Statistics, series D, as quoted in UNCTAD, "The Processing and Marketing of Primary Commodities: Approach to a framework of International Co-operation, TD/B/C.1/PSC/23, 24 November 1981.

Annex Table 7: Feasibility Score of Price Raising Action by Developing Country Producers: Selected Primary Products

Criteria	Weights	Petroleum	Bauxite	Phosphate rock	Copper	Tin	Iron Ore	Zinc	Lead	Uranium	Nickel	Manganese
1. Concentration of production and exports in developing countries	25	17	21	12	13	21	4	4	4	4	4	8
2. Price elasticity of demand (long-run)	25	18	19	13	19	13	13	9	9	10	6	6
3. Price elasticity of supply (long-run)	20	14	12	10	14	10	10	14	14	15	14	14
4. Presence of vertically integrated multinationals	10	8	10	5	2	2	6	8	8	5	7	8
5. Product homogeneity	5	2	3	2	3	2	2	1	1	2	1	2
6. Financial strength of producers	5	4	1	3	2	3	2	4	4	3	4	3
7. Stocks/scrap/recyclability	5	5	1	5	1	1	0	0	0	5	2	1
8. Relative dispersion of major buyers	5	4	3	3	2	3	2	2	2	1	2	2
Total Score	100	72	70	53	56	55	39	42	42	45	40	44

Notes: (1) Score is calculated by (i) taking 20 per cent of producers market share; (ii) and modifying on the basis of concentration among developing country exporters. High score indicates concentration.

(2) The price elasticity of demand was translated into a score using the following conversion scale.

Score	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0
Price Elasticity over	1.5	1.5 - 1.19	1.2 - 0.96	0.95 - 0.81	0.8 - 0.66	0.65 - 0.51	0.5 - 0.36	0.35 - 0.21	0.2 - 0.11	0.1 & less

(3) Scoring Conversion scale is as follows.

Score	2	4	6	8	10	12	14	16	18	20
Supply Elasticity over	1.5	1.5 - 1.19	1.2 - 0.96	0.95 - 0.81	0.8 - 0.66	0.65 - 0.51	0.5 - 0.36	0.35 - 0.21	0.2 - 0.11	0.1 & less

(4) Estimates based on knowledge of international commodity markets. High scores indicates oligopolistic market structure.
(5) Estimates based on knowledge of producing exporting countries.
(6) Estimates based on knowledge of major LDC exporters.
(7) Estimates based upon knowledge of the commodity and scrap markets. Low scores indicate the presence of scrap markets; high scores indicate that the product is destroyed in the act of consumption.
(8) Estimates of concentration and dispersion of importers. High scores indicate broad dispersion; low scores concentration.

Source: Computed by the author.

Annex Table 7 (contd.)

Feasibility Score of Price Raising Action by Developing Country Producers: Selected Primary Products

Criteria	Weights	Cocoa	Coffee	Tea	Sugar	Bananas	Cotton	Jute	Sisal	Rubber	Rice	Edible Oils	Tropical Timber
1. Concentration of production and exports in developing countries.	25	21	11	18	1	16	2	22	24	23	4	22	13
2. Price elasticity of demand (long-run)	25	20	19	18	24	16	18	10	10	11	20	18	13
3. Price elasticity of supply (long - run)	20	16	16	18	6	16	19	14	14	16	16	14	10
4. Presence of vertically integrated multinationals	10	4	3	3	2	8	3	2	2	4	3	2	4
5. Product homogeneity	5	2	2	1	3	2	3	3	3	3	3	0	1
6. Financial strength of producers	5	2	2	1	2	1	2	1	1	3	2	2	1
7. Stocks/scrap/recyclability	5	2	1	2	2	4	3	2	2	1	2	1	2
8. Relative dispersion of major buyers	5	3	3	3	3	3	2	2	2	3	3	3	3
Total Score	100	70	57	64	43	66	52	56	58	64	53	62	47

ANNEX II

METHOD OF ESTIMATING OPTIMAL EXPORT TAXES

1. Introduction

The rationale of this exercise stems from the wide-spread evidence and belief that inspite of protectionism in most parts of the world, demand elasticities are sufficiently low and production concentration in the developing countries sufficiently high for there to be a prima facie case for the application of the classical export tax argument (see chapter II section (a)).

The methodology followed is similar to that used in UNCTAD(1974), modified to allow for the calculation of commodity export taxes which maximise export revenue, welfare and export tax revenue. Some exploration is made of the consequences of shifts in the supply or demand schedules and of the payment of compensation as a means of inducing compliance with a uniform system of taxes.

To make this illustrative exercise tractable, two main simplifying assumptions are made. First, the world is classified according to four categories for each of the commodities analysed: the net exporters and net importers among the developing countries of the South, and the net exporters and net importers among the developed countries of the North. Second, the exercise is based on commodities and not countries. Thus, a number of strong partial equilibrium assumptions are made, and income, revenue and balance-of-payments effects are not allowed for in the model.

2. Definitions

The superscripts N and S are for North and South. The e and m subscripts are for net exporters and importers. The subscripts p,c and w are for producer, consumer and world prices. The definitions of symbols used are summarized in the following table.

	Developing Countries		Developed Countries		World
Apparent Consumption	D_e^s	D_m^s	D_e^N	D_m^N	D
Production	S_e^s	S_m^s	S_e^N	S_m^N	S
Exports, Imports	E^s	M^s	E^N	M^N	E,M
Prices, Producers	$p_{p,e}^s$	$p_{p,m}^s$	$p_{p,e}^N$	$p_{p,m}^N$	
Prices, Consumers	$p_{c,e}^s$	$p_{c,m}^s$	$p_{c,e}^N$	$p_{c,m}^N$	
World Price	p_w	p_w	p_w	p_w	
Export Revenue	E_r^s		E_r^N		E_r
Export Tax and Revenue	t^s, T^s	-	t^N, T^N	-	T
Demand Elasticities	$e_{d,e}^s$	$e_{d,m}^s$	$e_{d,e}^N$	$e_{d,m}^N$	
Supply Elasticities	$e_{s,e}^s$	$e_{s,m}^s$	$e_{s,e}^N$	$e_{s,m}^N$	
Shift in Demand Function(%)		Δ_d			
Shift in Supply Function (%)		Δ_s			

3. Elasticity and Price Relations

Defining export taxes as a fraction of producer prices, and introducing a set of constants, $K_{c,e}^s$, $K_{c,m}^s$... etc. to specify proportional relationships between world, producer and consumer prices to allow for transport costs and margins, the following price equations will apply:

$$p_w = (1 + t^s)\ K_{p,e}^s\ p_{p,e}^s$$

$$p_w = (1+t^N)\ K_{p,e}^N\ p_{p,e}^N$$

$$p_{c,e}^s = K_{c,e}^s\ p_{p,e}^s$$

$$p_{c,m}^s = K_{c,m}^s\ p_w$$

$$p^N_{c,e} = K^N_{c,e}\ p^N_{p,e}$$

$$P^N_{c,m} = K^N_{c,m}\ p_w$$

Defining $\dot{p}^s_{p,e} = \frac{dp^s_{p,e}}{dt} / p^s_{p,e}$, etc.

and $\dot{t}^s = \frac{dt^s}{dt} / (1 + t^s)$

$$\dot{t}^N = \frac{dt^N}{dt} / (1 + t^N)$$

where $\frac{d}{dt}$ indicates the total deviate with respect to time,

we find

$$\dot{p}_w = \dot{p}^s_{p,e} + \dot{t}^s \qquad (1)$$

$$\dot{p}_w = \dot{p}^N_{p,e} + \dot{t}^N \qquad (2)$$

and hence

$$\dot{p}^s_{c,e} = \dot{p}^s_{p,e} = p_w - \dot{t}^s \qquad (3)$$

$$\dot{p}^s_{c,m} = \dot{p}_w \qquad (4)$$

$$\dot{p}^N_{c,e} = \dot{p}^N_{p,e} = \dot{p}_w - \dot{t}^N \qquad (5)$$

$$\dot{p}^N_{c,m} = \dot{p}_w \qquad (6)$$

From which we derive the following elasticity relationships:

$$\dot{D}^s_e = e^s_{d,e}\ \dot{p}^s_{c,e} = e^s_{d,e}\ (\dot{p}_w - \dot{t}^s) \qquad (7)$$

$$\dot{D}^s_m = e^s_{d,m}\ \dot{p}^s_{c,m} = e^s_{d,m}\ \dot{p}_w \qquad (8)$$

$$\dot{D}^N_e = e^N_{d,e}\ \dot{p}^N_{c,e} = e^N_{d,e}\ (\dot{p}_w - \dot{t}^N) \qquad (9)$$

$$\dot{D}^N_m = e^N_{d,m}\ \dot{p}^N_{c,m} = e^N_{d,m}\ \dot{p}_w \qquad (10)$$

$$\dot{S}^s_e = e^s_{s,e}\ \dot{p}^s_{p,e} = e^s_{s,e}\ (\dot{p}_w - \dot{t}^s) \qquad (11)$$

$$\dot{S}^s_m = e^s_{s,m}\ \dot{p}^s_{p,m} = e^s_{s,m}\ \dot{p}_w \qquad (12)$$

$$\dot{S}^N_e = e^N_{s,e}\ \dot{p}^N_{p,e} = e^N_{s,e}\ (\dot{p}_w - \dot{t}^N) \qquad (13)$$

$$\dot{S}^N_m = e^N_{s,m}\ \dot{p}^N_{p,m} = e^N_{s,m}\ \dot{p}_w \qquad (14)$$

where $\dot{D}^s_e = \frac{dD^s_e}{dt} / D^s_e$ ..... etc.

4. Effects of change in taxes or exogeneous shift of demand or supply schedules on prices

If it is assumed that no country changes its position as a net exporter or importer of the commodity under consideration, then the following supply and demand balance relationship must hold after an exogeneous change in t or Δ :

$$\dot{D}^s_e\ \gamma^s_e + \dot{D}^s_m\ \gamma^s_m + \dot{D}^N_e\ \gamma^N_e + \dot{D}^N_m\ \gamma^N_m + \Delta_d$$

$$-\dot{S}^s_e\ \alpha^s_e - \dot{S}^s_m\ \alpha^s_m - \dot{S}^N_e\ \alpha^N_e - \dot{S}^N_m\ \alpha^N_m - \Delta_s = 0 \qquad (15)$$

where γ^s_e, γ^s_m ..... are the shares in demand

and α^s_e, α^s_m ..... are the shares in supply,

and it is assumed that D = S in the initial situation.

Substituting (7) - (14) into (15), we find

$$e^s_{d,e}\ (\dot{p}_w - \dot{t}^s)\ \gamma^s_e + e^s_{d,m}\ \dot{p}_w\ \gamma^s_m + e^N_{d,e}\ (\dot{p}_w - \dot{t}^N)\ \gamma^N_e$$

$$+e^N_{d,m}\ \dot{p}_w\ \gamma^N_m + \Delta_d - e^s_{s,e}\ (\dot{p}_w - \dot{t}^s)\alpha^s_e - e^s_{s,m}\ \dot{p}_w\ \alpha^s_m$$

$$-e^N_{s,e}\ (\dot{p}_w - \dot{t}^N)\alpha^N_e - e^N_{s,e}\ \dot{p}_w\ \alpha^N_m - \Delta_s = 0 \qquad (16)$$

Collecting terms in $\dot{p}_w$, we find

$$\dot{p}_w = \frac{(e^S_{d,e}\gamma^S_e - e^S_{s,e}\ \varepsilon^S_e)\dot{t}^S + (e^N_{d,e}\gamma^N_e - e^N_{s,e}\alpha^N_e)\dot{t}^N - \Delta_d + \Delta_s}{e^S_{d,e}\ \gamma^S_e + e^S_{d,m}\ \gamma^S_m + e^N_{d,e}\ \gamma^N_e + e^N_{d,m}\ \gamma^N_m - (e^S_{s,e}\ \alpha^S_e + e^S_{s,m}\alpha^S_m + e^N_{s,e}\alpha^N_e + e^N_{s,m}\alpha^N_m)} \quad (17)$$

$$= \frac{A^S\ \dot{t}^S + A^N\ \dot{t}^N - \Delta_d + \Delta_s}{B} \quad (17)$$

where the definition of A^S, A^N are given above. By substitution for $\dot{p}_w$ in (7) - (14), all the desired changes in demand and supply can be calculated. Note that A, B ≤ 0 as $e_d \longrightarrow \infty$, $\dot{p}_w \longrightarrow o$ for any of the demand elasticities. Also, the higher the elasticities of demand and supply in the exporting countries, the higher will be the impact of any given change of t^S or t^N, given other parameters. Conversely, the lower the demand and supply elasticities in the importing countries, the higher the price response, given other parameters.

5. Maximum Export Revenue

Total export revenue is given by

$$E_r = p_w\ (E^S + E^N)$$

$$\text{or} \quad \dot{E}_r = \dot{p}_w + \dot{E}^S\ \varepsilon + \dot{E}^N\ (1 - \varepsilon) \quad (18)$$

where ε is the export share of the South. Using the definition of E^S and E^N and substituting from (7) - (14), we find:

$$\dot{E}^S = \dot{S}^S_e\ \varepsilon^S_s - \dot{D}^S_e\ \varepsilon^S_d = e^S_{s,e}(\dot{p}_w - \dot{t}^S)\varepsilon^S_s - e^S_{d,e}(\dot{p}_w - \dot{t}^S)\varepsilon^S_d \quad (19)$$

$$\dot{E}^N = \dot{S}^N_e\ \varepsilon^N_s - \dot{D}^N_e\ \varepsilon^N_d = e^N_{s,e}(\dot{p}_w - \dot{t}^N)\varepsilon^N_S - e^N_{d,e}(\dot{p}_w - \dot{t}^N)\ {}^N_d \quad (20)$$

where $\varepsilon^S_s = S^S_e / (S^S_e - D^S_e)$

$$\varepsilon^S_d = D^S_e / (S^S_e - D^S_e)$$

and ε^N_s, ε^N_d follow in a similar fashion. Thus,

$$\dot{E}_r = \dot{p}_w + (e^S_{s,e}\varepsilon^S_s - e^S_{d,e}\ \varepsilon^S_d)\ (\dot{p}_w - \dot{t}^S)$$

$$+ (1 - \varepsilon)\,(e^{N}_{s,e}\,\varepsilon^{N}_{s} - e^{N}_{d,e}\,\varepsilon^{s}_{d})\,(\dot{p}_w - \dot{t}^{N})$$

$$= \dot{p}_w + C^{s}\,(\dot{p}_w - \dot{t}^{s}) + C^{N}(\dot{p}_w - \dot{t}^{N})$$

where C^{s} and C^{N} are defined as above.

Collecting terms in $\dot{p}_w$ and substituting from (17^{1}):

$$\dot{E}_r = \frac{A^{s}\,\dot{t}^{s} + A^{N}\dot{t}^{N} - \Delta_d + \Delta_s}{B}\,(1 + C^{s} + C^{N}) + C^{s}\dot{t}^{s} + C^{N}\dot{t}^{N}$$

Collecting terms in $\dot{t}^{s}$, $\dot{t}^{N}$, Δ_d and Δ_s ,

$$\dot{E}_r = \left[\frac{A^{s}}{B}(1 + C^{s} + C^{N}) + C^{s}\right]\dot{t}^{S} + \left[\frac{A^{N}}{B}(1 + C^{s} + C^{N}) + C^{N}\right]\dot{t}^{N}$$

$$= \frac{\Delta_d}{B} + \frac{\Delta_s}{B}$$

$$= F^{s}\,\dot{t}^{s} + F^{N}\dot{t}^{N} - \frac{\Delta_d}{B} + \frac{\Delta_s}{B}, \qquad (21)$$

where F^{s}, F^{N} are defined as above.

Thus for export revenue maximization $E_r = 0$

6. Optimal Export Tax

Case I: Tax on all exports, and $\dot{t}^{s} = \dot{t}^{N} = t$.

By definition, $E_r = E_p$, (where $E = E^{N} + E^{s}$), thus

$$E_r = \dot{p}_w + \dot{E}. \qquad (22)$$

Marginal revenue from exports is given by

$$\frac{dE_r}{dE} = \frac{\dot{E}_r}{\dot{E}} = p_w$$

$$= p_w\left(1 + \frac{1}{\eta_d}\right) \qquad (23)$$

using (22), where $\eta_d = \frac{\dot{E}}{\dot{p}_w}$, the elasticity of demands for exports. Now the optimal export tax reqires that marginal revenue and supply price are equated. Here it is preferable to define $t^* = \frac{t}{1+t}$ where t^* is measured as a fraction of world price. Setting the k's equal to 1 for simplicity, we require

$$p_w(1 - t^*) = p_w(1+\frac{1}{\eta_d})$$

or

$$t^* = \frac{1}{\eta_d} \qquad (24)$$

which is the same as Corden (1974, p.160). For the purposes of calculation, we can estimate η_d at every step as t (or t^*) is increased, until we reach the optimum designed by (24).

Case II: Tax on South exports only.

This is the same as 1, except that $\dot{t}^N = 0$. Equations (22)-(24) can be rewritten as

$$\dot{E}_r^s = \dot{p}_w + \dot{E}^s \qquad (22^1)$$

$$\frac{dE_r^s}{dE^s} = p_w(1 + \frac{1}{\eta_d^s}) \qquad (23^1)$$

where $\eta_d^s = \frac{\dot{E}^s}{p^w}$,

and the optimal export tax will be

$$t^{*s} = -\frac{1}{\eta_d^s}$$

Note, of course, that this is only the optimum tax from the point of view of the producing countries of the commodities in question, either all producers or the South producers. For this to be beneficial from the world point of view, we need to explicitly note that the welfare weight of all other producers and consumers is zero.

7. Maximum Export Tax Revenue

The export tax revenue for $\dot{t}^S = \dot{t}^N = t$ and for $\dot{t}^N = 0$ are given by

$$T = p_w E t^* \tag{25}$$

$$T^S = p_w E^S t^{*S} \tag{26}$$

The condition for maximum export tax revenue is simply

$$\dot{T} = \dot{p}_w + \dot{E} + \dot{t}^* = 0 \tag{27}$$

$$\dot{T}^S = \dot{p}_w + \dot{E}^S + \dot{t}^S = 0 \tag{28}$$

This can be easily calculated in the iterative procedure proposed below.

8. Iterative Calculation

Given the estimates of supply and demand for each commodity in a base year, the estimates of the supply and demand elasticities, and an initial set of share parameters can be calculated. Then, for changes in $\dot{t}^S$, $\dot{t}^N$ as desired, and for Δ_d, $\Delta_s = 0$, the changes in all variables and a new set of values can be calculated. This, in turn, enables the re-estimation of the share parameters and a new iteration can begin for any specified $\dot{t}$. Setting $\dot{t} = .01$ seemed to work well. At any desired level of export taxes, by setting Δ_d or Δ_s equal to + or - .01, estimates of the effects of such a change in a demand or supply function can easily be made. These calculations form the basis of estimating either the consequences of shifts in supply and demand for some effect not captured in the shifts along the functions (a major substitution effect at some threshold price) or of the expansion of supply outside the taxed area. The latter calculations form the basis of estimating possible compensation which could be paid to induce new suppliers not to operate outside the tax system under analysis.